Dissertation On

A STUDY ON MICROALBUMINURIA IN PATIENTS WITH PRIMARY HYPERTENSION AND ITS RELATIONSHIP WITH TARGET ORGAN DAMAGE

Dissertation submitted for the partial fulfillment of

Doctor of Medicine
Branch I- GENERAL MEDICINE

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY,
CHENNAI – 600 003

APRIL 2011

CERTIFICATE

This is to certify that the dissertation work on *"**A study on Microalbuminuria in patients with primary hypertension and its relationship with target organ damage"*** is the bonafide work done by **Dr.C.Lalitha** in the Institute of Internal Medicine, Madras Medical College, Chennai – 600 003 during the year 2008 – 2011 under my supervision and guidance in partial fulfillment of the regulation laid down by **The Tamil Nadu Dr.M.G.R.Medical University,** for the Doctor of Medicine Branch- I: General medicine examination to be held in April 2011.

Dr.C.Rajendran, MD
Director,
Institute of Internal Medicine,
Madras Medical College,
Chennai – 600 003.

Dr.P.Chitrambalam, MD.,
Professor of Medicine,
Institute of Internal Medicine,
Madras Medical College,
Chennai-600 003.

Dr.J.Mohana Sundaram, M.D.,D.N.B, Ph.D.,
Dean,
Madras Medical College,
Chennai – 60 003.

DECLARATION

I, **Dr.C.LALITHA,** solemnly declare that this dissertation entitled *"**A study on Microalbuminuria in patients with primary hypertension and its relationship with target organ damage"*** is a bonafide work done by me at Madras Medical College and Government General Hospital from February 2010 to October 2010 under the guidance and supervision of my unit Chief **Prof.P.Chitrambalam, MD.,** Professor of Medicine, Institute of Internal Medicine, Madras Medical College, Chennai.

This dissertation is submitted to The Tamil Nadu Dr.M.G.R. Medical University, towards fulfillment of regulation for the award of M.D. degree (Branch- I) in General Medicine.

(Dr.C.LALITHA)

Place : Chennai
Date :

ACKNOWLEDGEMENT

I thank **Prof.Dr.J.MOHANASUNDARAM**, **MD., DNB., Ph.D.,** Dean, Madras Medical College, Chennai – 3 for permitting me to use the resources and clinical materials of this hospital for my study.

I express my thanks and deep gratitude to our respected Professor and Director, Institute of Internal Medicine, **Prof.Dr.C.RAJENDRAN, MD.,** for his inspirational guidance.

I extend my gratitude and sincere thanks to our respected unit chief **Prof.Dr.P.CHITRAMBALAM,MD**., for his support, encouragement and guidance during the study period.

I sincerely thank my Assistant Professors **Dr.K.V.RAJALAKSHMI, MD, Dr.S.SIVARAM KANNAN, MD.,** for their guidance and kind help.

I am thankful to **Dr.PRAGNA. B.DOLIA**, Professor and Director, Institute of Biochemistry and her team for their help and Co-operation.

Last but not the least, with sincere gratitude: I thank all the patients and controls who contributed so much to this study without whom this study would not have been possible.

CONTENTS

BIBLIOGRAPHY

1) 2003 European society of hypertension – European society of cardiology guidelines for the management of arterial HTN. I Hypertens. 2003; 21: 1011-1053).

2) Abid O, Sun Q, Sugimoto K, Mercan D, Vincent JL (2001). "Predictive value of microalbuminuria in medical ICU patients: results of a pilot study". Chest 120 (6): 1984–8.

3) Agrawal B, Berger A, Wolf K, Luft FC: Microalbuminuria screening by reagent strip predicts cardiovascular risk in hypertension. J Hypertens 14: 233-228, 1996.

4) Arnold JM, Yusuf S, Young I, et al. Prevention of heart failure in Patients in the Heart Outcomes Prevention Evaluation (HOPE) Study. Circulation 2003; 107: 1284-90.

5) Ascherio A, Hennekens C, Willet WC, et al. Prospective Study of nutritional factors, blood pressure and hypertension among U.S. Women. Hypertension.1998;207:1065

6) Assadi F.Effect of microalbuminuria lowering on regression of left ventricular hypertrophy in children and adolescents with essential hypertension. Pediatr Cardiol 2007; 28: 27-33.

7) Beamer NB, Coull BM, Clark WM, Wynn M. Microalbuminuria and cardiovascular risk in hypertensive patients with left ventricular hypertrophy: The LIFE Study. Ann Intern Med 2003; 139:901-06.

8) Brunner HR, Sealy JE, Laragh JH. Renin Subgroups in essential hypertension. Circ Res 32 (Suppl 1) 1973;99

9) Burt VL, Whelton P, Roccella EJ, et al. Prevalence of hypertension in US adult Popln. Results from third national health and Nutrition Examination Survey. 1988-1991. Hypertension.1995;25:3050.

10) Cardillo C, Killcoyne CM, Nambi S, et al. Vasodilator response to systemic but not to total hyperinsulinemia in the human forearm. Hypertension, 1998; 32: 740.

11) Cardillo C, Killcoyne, Wallawiw M, et al. Role of endothelin in the increased vascular tone of Patients with essential hypertension, Hypertension. 1999; 33: 575.

12) Chobanian AV et al: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The JNC 7 Report. JAMA 289:2560, 2003 [PMID: 12748199]

13) Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, et al. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure the JNC-7 Report. JAMA 2003; 289 : 2560-72.

14) Ciucci et al Prognostic significance of CR in hypertens with normal LV mass J M coll cardiol 1995; 25: 871-8.

15) Cushman-Burden of uncontrolled hypertension: morbidity and mortality with disease progression J clin Hypertens 2003;5:14-22.

16) Deepa R, Shanthirani CS, Pradeepa R, Mohan V. Is the 'rule of halves' in hypertension still valid?--Evidence from the Chennai Urban Population Study. J Assoc Physicians India 2003; 51 : 153-7.

17) Devereux et al Carotid mid. wall strain stress relation in hypertens Hypertens 1999.33:793-9

18) Dominiazek-AF, Negrin DC, Clark JS et al. Genes and hypertension. From gene mapping in experimental models to vascular gene transfer strategies, hypertension.2000;35:164-172.

19) Gupta R, Gupta VP, Sarna M, Bhatnagar S, Thanyi J, Sharma V, et al. Prevalence of coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch-2. V. Indian Heart J 2002; 54:59-66.

20) Harmoinen H, Various P, Jokela H: Turbidimetric measurement of micro albumuria. Clin. Chen Alta 166: 85-89, 1987.

21) Harrap SB: Hypertension: Genes Versus environment. Lancet. 1994; 344: 169.

22) Hitha B, Pappachan J M et al. Microalbuminuria in patients with Essential Hypertension and its Relationship to Target organ Damage: An Indian Experience. Saudi J kidney Dis Transpl 2008; 19(3):411-419

23) Jalal S, Sofi SA et al. Prevalence of microalbuminuria in essential hypertension: A study of patients with mild to moderate hypertension. Indian J Nephrol 2001;11:6-11.

24) Jensen JS,Borch –Johnson K,Jensen G,Fedlt-RasmussenB.Microalbuminuria reflects a generalized transvascular leakiness in clinically heathy subjectsClin Sci 1995;88:629-633.

25) Joshi SR, Parikh RM. India--diabetes capital of the world: now heading towards hypertension. J Assoc Physicians India 2007; 55 : 323-4.

26) Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. Lancet 2005; 365 : 217

27) Keith NM, Wagener HP, Barker NW (1939) Some different types of essential hypertension: their course and prognosis. Am J Med Sci, 197, 332–43.

28) Kim J.R, Kiefe CI, Liu K, et al. Heart rate and subsequent blood pressure in young adults. The CARDIA Study. Hypertension.1999; 33: 640

29) Levy ef al: prognostic implication of echo determined LV Mass in Framingham study: NEJM 1990 326:1561-6 48.

30) Liese AD, Mayer-Davis EJ, Haffner SM: Development of multiple metabolic syndrome: An epidemiologic prospective. Epidemiol Rev. 1998; 20: 157.

31) Mani MK. Experience with a program for prevention of chronic renal failure in India. Kidney Int suppl 2005;S75-78.

32) MesserliFH, WilliamsB,Ritz E.Essential Hypertension.Lancet 2007; 350: 591-603.

33) Mohan V, Deepa M, Farooq S, Datta M, Deepa R. Prevalence, awareness and control of hypertension in Chennai--the Chennai Urban Rural Epidemiology Study (CURES-52). J Assoc Physicians India 2007; 55 : 326-32.

34) Pedrinelli R,Giampietro O,Carmasi F.Microalbuminuria and endothelial dysfunction in essential Hypertension. Lancet. 1994; 344: 14-18.

35) Pratt RE, Dzau VJ. Genomics and hypertension concepts, Potential and Opportunities. Hypertension. 1999; 33: 238

36) Richards AM. The Natriuretic peptides and hypertension. J.Inter Med.1998; 235: 1284

37) Russell LB, Valiyeva E, Carson JL. Effects of prehypertension on admissions and deaths: a simulation. Arch Intern Med 2004; 164: 2119-24.

38) Samani NJ. Genetics of hypertension. The oxford Text Book of Medicine, 4th edition, 2003: Pp 1160 - 1164.

39) Sealy JE, Blumenfeld JD, Bell GM, et al. On the renal basis for hypertension. J Hypertension.1988; 6: 763.

40) Shihabi ZK, Konen JC, Corner ML; Albuminuric Vs Urinary total protein for collecting Chr.Renal disorders. Clin Chem 37: 621-624, 1991.

41) Silkensen, JR, Kasiske BL: Laboratory assessment of renal disease: Clearance, urinals and renal biopsy. In-BM (ed): Brenner and Rctars. The kidney 7th ed, Philadelphia Saunders, 2004, Pp 1107- 1150.

42) Sokolow M, Lyon TP. The ventricular complex in left ventricular hypertrophy as obtained by unipolar precordial and limb leads. Am Heart J. 1949;37:161–186.

43) Torun D, Sezer S, Arat Z, Pelit A, Yigit F, Ozdemir FN. The frequency of combined target organ damage and the beneficial effect of ambulatory blood presence monitoring in never treated mild-to-moderate hypertensive patients. Int. Heart J 2005;46: 1073-82.

44) Tsioufis C, Dimitriadis K, Chatzis D, et al. Relation of microalbuminuria to adiponectin and augmented C-reactive protein in men with essential hypertension. Am J Cardiol 2005;96:946-51.

45) Ulla Derhaschnig, Harald Kittler, Christian worsetschlarger, Andrews Bur, Harald Hekner and Michael M.Hirschl. Microalbuminuria measurement above or collection of the albumin / Creatinine ratio for the screening of hypertension patients? Nephrol. Dial transplant (2002) 17: 81-85.

46) Wachtell K, Palmieri V,Olsen MH, et al. Urine albumin/Creatinine ratio and echocardiographic left ventricular structure and function in hypertensive patients with electrocardiographic left ventricular hypertrophy: the LIFE study. Losartan Intervention for Endpoint Reduction. Am Heart J 2002; 143: 319-26.

47) Yadav S, Boddule R, Genitta G, Bhatia V, Bansal B, Kongara S, et al. Prevalence & risk factors of pre-hypertension & hypertension in an affluent north Indian population. Indian J Med Res 2008; 128 : 712-20.

ABBREVIATION

BP	Blood Pressure
TOD	Target Organ Damage
JNC	Joint National Committee
HTN	Hypertension
MI	Myocardial Infarction
CVA	Cerebro Vascular Accident
CAD	Coronary Artery Disease
OCP	Oral Contraceptive Pills
HRT	Hormone Replacement Therapy
NO	Nitric Oxide
HMW	High Molecular Weight
DCT	Distal Convoluted Tubule
LVH	Left Ventricular Hypertrophy
MA	Microalbuminuria

INSTITUTIONAL ETHICAL COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No: 04425305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr. C. Lalitha
PG in MD General Medicine
Institute of Internal Medicine
Madras Medical College, Chennai -3

Dear Dr. C. Lalitha

The Institutional Ethical Committee of Madras Medical College reviewed and discussed your application for approval of the project / proposal entitled " Subclinical Target Organ Dysfunction – a Study of early markers in primary hypertensives" No. 010610

The following members of Ethical committee were present in the meeting held on 11.06.2010 conducted at Madras Medical College,

1.	Prof. S.K. Rajan, MD	-- Chairperson
2.	Prof. J. Mohanasundaram, MD,Ph.D,DNB Dean, Madras Medical College, Chennai -3	-- Deputy Chairman
3.	Prof. A. Sundaram, MD Vice Principal , MMC, Chennai -3	-- Member Secretary
4.	Prof. R. Sathianathan, MD Director, Institute of Psychiatry	-- Member
5.	Prof R. Nandhini, MD Director, Institute of Pharmacology, MMC, Ch-3	-- Member
6.	Prof. Pregna B. Dolia , MD Director, Institute of Biochemistry, MMC, Ch-3	-- Member
7.	Prof. C. Rajendran , MD Director, Institute of Internal Medicine, MMC, Ch-3	-- Member -- Member
8.	Prof. Geetha Subramanian, MD,DM Professor & Head , Dept. Of Cardiology	-- Member
9.	Prof. V. Shruti Kamal, MS Professor of Surgery, MMC, Ch-3	-- Member
10.	Prof. Md. Ali, MD, DM Professor & HOD of Medical Gastroenterology, MMC,	-- Member -- Member
11.	Tmt. Arnold Souline	-- Social Scientist

We approve the trail to be conducted in its presented form.

Sd/. Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information / informed consent and asks to be provided a copy of the final report

Member Secretary, Ethics Committee.

INTRODUCTION

Hypertension is one of the most common cardiovascular disorders and it is an emerging health problem in India. When people come to know that they have hypertension most of them have already progressed into severe stage with target organ damage- a fatal stroke or myocardial infarction or irreversible renal failure.

Unfortunately even in developed countries like Unites States 30% of hypertensives are unaware of its presence in them. Only 59% of known hypertensives are on treatment and only 34% have good control of their blood pressure.

The cost effectiveness of BP reduction with drugs will be greater in the presence of target organ damage. In this context assessment of subclinical TOD has become the key element in evaluating hypertensive patients to prevent further damage. Micro albuminuria is one of the earliest indicators of TOD in hypertensives.

Micro albuminuria reflects vascular damage and appears to be a marker of early arterial disease and endothelial dysfunction.

So early screening of hypertensives for microalbuminuria and prompt treatment of positive cases will reduce the target organ damage and cardiovascular morbidity in the community.

AIMS & OBJECTIVES

-To find out the prevalence of microalbuminuria in patients with Primary Hypertension.

-To assess the relationship of the microalbuminuria with duration, severity of Hypertension and previous treatment.

-To find out the relationship of microalbuminuria with TOD in patients with Primary Hypertension like LVH, Stroke and Retinopathy

REVIEW OF LITERATURE

PRIMARY HYPERTENSION

Definition of Hypertension:

The simplest and most widely accepted definition of hypertension in an adult is that hypertension is present when clinic systolic BP exceeds 140 mmHg or clinic diastolic BP exceeds 90 mmHg. The patients with blood pressure more than 140/90 and without any secondary demonstrable causes of elevated blood pressure are called as primary or essential hypertensives.

The JNC-7 definition of hypertension reproduced in the following table gives a more detailed classification of blood pressure for adults aged over 18 years.

Classification of Blood Pressure for adults ages 18 yrs and older *

Category	*Blood Pressure (mmHg)*	
	Systolic	***Diastolic***
Optimal	< 120	< 80
Pre hypertension	120 -139	80 -89
Hypertension +		
Stage 1	140- 159	90-99
Stage 2	$\geq$ 160	$\geq$ 100

* Not taking antihypertensive drugs and not acutely ill.

\+ based on the average of two or more readings taken at each of two or more visits after initial screening.

Prevalence:

On a global level, hypertension is a greater problem, with 13.5% of all deaths attributed to BP related diseases. A majority of those who carry this disease burden belong to lower economic strata.

Hypertension is reported to be the fourth contributor to premature death in developed countries and the seventh in developing countries. (Mohan V et al, 2003) .Recent reports indicate that nearly 1 billion adults (more than quarter of the world population) had hypertension in 2000, and this is predicted to increase to 1.56 billion by 2025. (Kearney PM et al, 2005) Earlier reports also suggest that the prevalence of hypertension is rapidly increasing in developing countries and is one of the the leading causes of death and disability in them.

The prevalence of HTN depends on both the racial compositions of the population studied and the criteria used to define the condition. The prevalence of HTN among blacks is greater at every age beyond adolescence and they have a greater proportion of more severe disease with higher mortality rate than whites at every level of outcome (Burt VL et al, 1995).

Indian Scenario:

The Jaipur Heart watch study (Gupta R et al, 2002) and the Chennai Urban Rural Epidemiology Study (CURES) reported the prevalence and hypertension to be 37% and 20% using the JNC-VII guidelines.

Data of study by Yadav et al suggested that the prevalence of hypertension in the younger age group (30-39 years) was 13.7% and increased to a peak of 64% in the age group 60-69 years while prevalence of pre- hypertension was highest in the age group 30-39 years (36%). A similar prevalence of pre hypertension in the same age group (35.4%) has been reported in Chennai population (Mohan V ,et al).

The prevalence of hypertension will increase even further unless broad and effective prevalence measures are implemented at this stage as India is a vast country with a heterogenous and young population.As rightly commented by Joshi & Parikh, with current rate of hypertension India will have the largest number of people with hypertension in the world, with the potential of becoming the“Hypertension capital of the world “(Joshi SR et al, 2007).

Likely Benefits of Treatment:

The relative risk of high BP for M.I & CVA is higher among younger subjects and decreases with age. Absolute risk, by contrast increase with age. This means that attributable risk, which is the no of events that would be avoided if BP were lower, is likely to be higher in the elderly. The attributable risk of diastolic BP for CAD is likely to be great because coronary artery disease is more common than stroke in most western populations.

Gender Differences:

Hypertension is an important risk factor for cardiovascular disease in women. Although premenopausal women have lower BP than age matched men the prevalence of HT is higher in women than men after the age of 65. Obesity is significantly more common in middle aged and older women and is likely to contribute to cross over in prevalence. OCP increases the risk of HT is younger women.

HRT does not raise the BP in women who are normotensive at the start of treatment. The ratio of hypertension frequency in women versus men increase from 0.6 to 0.7 at age 30 to 1.1 to 1.2 at age 65 yrs.

Complications of Hypertension:

The higher the level of the blood pressure, the more likely that various cardiovascular disease will develop prematurely through acceleration of atherosclerosis, the pathological hall mark of uncontrolled hypertension. In untreated, about 50% of hypertensive patients die of CAD or congestive failure about 33% of stroke and 10 - 15% of renal failure.

In general the vascular complications of hypertension can be considered as either hypertensive or atherosclerotic.

I. Hypertensive complications

1) Accelerated malignant phase
2) Hemorrhagic stroke
3) Congestive heart failure
4) Nephrosclerosis
5) Aortic dissection

II. Atherosclerotic complications:

1) Coronary artery disease
2) Sudden death
3) Arrhythmias
4) Atherothrombotic stroke
5) Peripheral vascular disease

Aetiopathogenesis of Primary Hypertension

This can be described under the following headings

1. Non renal factors.
2. Renal factors

I.Non - Renal Factors:

Primary Hypertension is a complex multifactorial and polygenic disorder that results from an interaction between an individual's genetic back ground and various environmental factors.

1.Genetic Predisposition:

The genetic contributions in the etiopathogenesis of primary HT have been estimated to range from 30% to 60%. Harrap suggested that "the average population blood pressure is determined by environment but the blood pressure rank within the distribution is decided largely by genes". (Harrap, 1994)

Epidemiological data suggest that for population variability in blood pressure genetic factors contribute 30 - 35%, common household environment about 10 - 15% and non familial factors for the remaining 50 - 55%. (Samani N.J., 2003)

If genetic markers of a predisposition for the development of hypertension are found, specific environmental manipulations could then be directed toward susceptible subjects. (Pratt R E, Dzau VI, 1999).

Pratt, from his observation of bimodal distribution of blood pressure in some families with hypertensive subjects proposed autosomal dominant mode of inheritance. Pickering proposed that blood pressure is a quantitative trait with genetic contribution which is polygenic.

Genome wide scanning strategy in sib-pairs has identified chromosomal regions on chr 6, 15, 5 and 12 which showed significant linkage to genes that influence interindividual blood pressure variation. There are several candidate genes within the identified group. (Dominiazek AF, Negrin DC, Clark JS el al, 2000).

Polymorphism of genes involving the RAS system, aldosterone synthesis and adrenergic receptors has been noted to be more common in hypertensive than normotensive patients.

The rare forms of hypertension by a monogenic abnormality are

1) Glucocorticoid remediable aldosteronism
2) Liddle syndrome
3) Apparent mineralocorticoid excess

2.The Fetal Environment:

Low birth weight as a consequence of fetal under nutrition is followed by an increased incidence of high blood pressure later in life. Brenner and Cheriow hypothesized that a decreased number of nephrons from intrauterine growth retardation could very well serve as this permanent, irreparable defect that eventuates in hypertension.

3. Vascular Remodelling:

Folkow hypothesized that, in the pathogenesis of primary hypertension, .various neurohumoral factors initially increase the peripheral vascular resistance but perpetuation of hypertension involves vascular remodelling mainly by vascular hypertrophy. This vascular hypertrophy may be further reinforced by defects in vascular cell membrane and various trophic mechanisms.

4. Neurohumoral Causes of Primary Hypertension:

A large number of circulating hormones and locally acting substances may be involved in the development of hypertension.

a) Sympathetic nervous hyperactivity:

Young hypertensives tend to have increased levels of circulating catecholamines, augmented sympathetic nerve traffic in muscles, faster heart rate and heightened vascular reactivity to adrenergic agonists. (Kim J-R, Kiefe CI, Liu K, el al, 1999)

These changes could raise blood pressure in a number of ways - either alone or in concert with stimulation of renin release by catecholamines by causing arteriolar and venous constriction or

by increasing cardiac output or by alter the normal renal pressure - volume relationship.

b) Renin - Angiotensin system:

Both as a direct pressor and as a growth promoter the renin angiotensin mechanism may also be involved in the pathogenesis of hypertension. This system is the primary stimulus for the secretion of aldosterone and hence mediates mineralocorticoid responses to varying sodium intake and volume load.

When large populations of hypertensives are surveyed, only about 30 percent have low PRA, where as 50 percent have normal levels and the remaining 20 percent have high levels. (Brunner HR, Sealey JE, Laragh JK, et al 1973).

Normal & high renin hypertension:

Some persons with primary hypertension have normal or high renin levels. The concept of "Nephron heterogeneity" described by Sealey and colleagues, which assumes a mixture of normal and ischemic nephrons caused by afferent arteriolar narrowing. Excess renin from the ischemic nephrons could raise the total blood renin level.

c) Hyper insulinemia / insulin resistance:

An association between hypertension and hyper insulinemia has been recognised for many years, particularly with accompanying obesity but also in non obese hypertensives. (Liese AD, Mayer - Davis EJ, Haffner SM 1998). This association does not apply to pima Indians but it has been found in blacks, Asians and as well as whites. The impairment of the peripheral actions of the insulin resulting from a defect in the usual vasodilatory effect of insulin mediated through increased synthesis of nitric oxide which normally counters the multiple pressure effect of insulin.

(Cardillo C, Killcoyne CM, Nambi S, et al 1998) These pressor effects, in addition to activation of sympathetic activity, include a trophic actions on vascular hypertrophy, increased renal sodium reabsorption and structural - changes in the myocardium.

The failure of vasodilatation to antagonize the multiple pressure effects of insulin presumably eventuates in rise in blood pressure that may be either a primary cause of hypertension or at least a secondary potentiator.

d) Endothelial cell dysfunction:

The impairment of normal vasodilatation in the insulin resistance syndrome has been shown to involve failure to synthesize the normal endothelium derived relaxing factor (NO).

Nitric Oxide:

Hypertensive patients have been shown to have a reduced vasodilatory response to various stimuli of NO release that appears to be independent of the etiology of the hypertension and the degree of the gross vascular structural alteration. Impaired NO mediated vasodilatation may promote abnormal vascular remodelling and may be involved in the greater propensity for vascular damage in blacks than in whites. NO - mediated forearm responsiveness has been restored by normalization of blood pressure by anti hypertensive drugs with different modes of actions.

Endothelin:

Endothelin - 1 causes pronounced and prolonged vaso constriction and because inhibitors of its synthesis or binding cause significant vasodilatation. (Cardillo C, Killcyone CM, WaclawillM, et al 1999).

e) Minerals:

Excess of lead and changing ratios among dietary sodium, potassium, calcium and magnesium have also been postulated in pathogenesis of primary HT. (Ascherio A, Hennekens C, Willet WC et al 1998)

II. Renal retention of excess dietary sodium:

To induce hypertension, some of the excess sodium must be retained by the kidneys. Such retention could arise in a number of ways.

1) Nephron hetrogeneity: which is hypothesized by Sealey and co-workers as the presence of "a sub population of nephrons that is ischemic either from afferent arteriolar vasoconstriction or from an intrinsic narrowing of the lumen. Renin secretion from this sub group of nephrons is tonically elevated. This increased renin secretion then interferes with the compensatory capacity of intermingled normal nephrons to adaptively excrete sodium and consequently, over all blood pressure homeostasis. (Sealey JE, Blumenfeld, Bell GM et al 1988).

2) An acquired inhibitors of the sodium pump (or) other abnormalities in sodium transport.

3) Deficient responsiveness to atrial natriuretic hormones. (Richards AM, 1998)

4) Decreased potassium intake as a contributor to the excess no of cases of hypertension found in people of low S.E.S.

5) A decrease in filtration surface by a congenital or acquired deficiency in nephron number or function.

Proteinuria

Physiology:

Upper limit of normal total urine protein excretion is 150 to 200mg/ day for adults.

The upper limit of normal albumin excretion is usually given as 30mg/ dl. (Shihabi ZK et al ,1991).

A very small amount of protein that normally appears in the urine is the result of normal tubular secretion. Tamm-Harsfal protein is an HMW glycoprotein that is formed in the thick ascending loop of the Henle & early DCT.

Normally large quantities of large high molecular weight (HMW) plasma proteins traverse the glomerular capillaries, mesangium or both without entering the urinary space. The normal glomerular endothelial cell forms a barrier composed of pores of 100nm that hold back blood cells but other little impediment to passage of most proteins.

Both charge and size selective properties of the capillary wall prevent all large plasma proteins from crossing. LMW proteins are normally reabsorbed by the proximal tubule. Thus proteins such as alpha2 microglobulin, apoproteins, enzymes, and peptide hormones are normally excreted only very small amounts in urine. The proteins secreted by tubules are Tamm-Harsfall, IgA and urokinase.(Silkensen, JR et al, 2004)

Pathophysiology:

Abnormal amount of proteins may appear in urine as the result of three mechanisms.

1) A disruption of the capillary wall barrier may lead to a large amounts of HMW plasma proteins that over whelm the limited capacity of tubular reabsorption and cause which is called of glomerular proteinuria.

2) Tubular damage/ Dysfunction can inhibit the normal response capacity of PCT resulting in incread amounts of mostly LMW proteins to appear in the urine, that is called as tubular proteinuria.

3) Increased production of normal (or) abnormal plasma proteins can be filtered at the glomerular and over helms the responsive capacity of PCT.

In some diseases like minimal change disease, there is a fusion of glomerular epithelial cell foot processes resulting in “selective” loss of albumin. Other glomerular diseases like in immune-complex deposition there is disruption of basement memrane and slit diaphragms resulting in losses of albumin and other plasma proteins. The fusion of foot processes causes increased pressure across the capillary basement memrane resulting in areas with larger pore sizes. The combination of increased pressure and larger pores results in significant (Nonselective) proteinuria.

Definition of Abnormal Albumin Excretion

Category	*24 hrs collection mg/24min*	*Timed collection (μ/min)*	*Spot collection (mg/g of creatinine)*
Normal	< 30	< 20	< 30
Micro albumin	30 – 299	20- 199	30 – 299
Clinical albuminuria	> 300	> 200	> 300

Urine Albumin Concentration can be Quantified by a Number of Assays Including

1. Radio- immunoassay
2. Immunotubimetric technique- Depends on the turbidity of a solution when albumin in a sample of urine reacts with a specific antibody. The turbidity is measured with a spectrophotometer and the absorbency is propotional to the albumin concentration. (Harmoinen H et al, 1987).
3. When albumin in the urine sample react with a specific antibody, it forms light scattering antigen-antibody complexes that can be measured with a laser naphelometer. The amount of albumin is propotional to scatter in the signal.
4. Competitive ELISA
5. High performance liquid chromatography (HPLC)

The ACR did not provide any advantage in terms of positive or negative prediction and required a higher laboratory effort.Microalbumin measurement alone is the most convenient screening method in daily clinical practice (Ulla Derhaschnig et al, 2002).

Micro Albuminuria

Viberty and Co workers coined the term microalbuminuria to indicate increased urine albumin excretion rates in patients with normal urine total protein. (Viberti GC et al 1982.)

Micro albuminuria is defined as

1) Urine Albumin excretion of 30 to 300mg/ day (Abid D et al, 1984)
2) 20 to 200mg/ g of Creatinine in males and 30 to 300mg / gm of Creatinine in females. (Mattix HJ et al 2002)s
3) ACR – 2.0 – 20 mg/ mmol in men, 2.8- 28mg/mmol in women.

In patients with primary hypertension, increased urine albumin exertion ratio is associated with increased cardio vascular morbidity.

In a study of >11,000 non diabetic hypertensives, the presence of micro albuminuria was associated with significantly higher prevalence of LVH, CAD, MI, Hyperlipidemia and peripheral vascular disease (Agrawal B et a1 ,1996).

These is a link between the hypertensive heart disease and changes in glomerlar hemodynamic profile in primary hypertension. Patients with hypertension and LVH have higher GFR and filtration fraction than those without ventricular hypertrophy. Glomerular hyperfiltration in patients with HTN is related to cardiac remodeling and perhaps, more generalized vascular adaptation.

Pathophysiology

It has been hypothesized that microalbuminuria reflects diffuse endothelial dysfunction (Pedrinelli R et al, 1994), leading to generalized transendothelial sieving of albumin. (Jensen JS et al 1995). It is likely that MA emerges later in the atherosclerotic process (Agewall S et al, 1995).

Mechanism of function of microalbuminuria in patients with primary hypertension.

1) Increased transglomerular passage of albumin due to hyperfiltration.
2) Glomerular basement membrane abnormalities
3) Endothelial dysfunction
4) Nephrosclerosis

Measurement of MA is in some guidelines recommended for risk stratification in people with HTN.

(2003 European society of hypertension – European society of cardiology guidelines for the management of arterial HTN. 2003).

Significance of Microalbuminuria

1) An indicator of subclinical cardiovascular disease.
2) Marker of vascular endothelial dysfunction.
3) An important prognostic marker for kidney disease in hypertension and Diabetes Mellitus
4) A risk factor for venous thromboembolism
5) Increasing microalbuminuria during first 48 hours after admission to an ICU predicts elevated risk for acute respiratory failure, multi- organ failure and over all mortality.

Hypertensive Retinopathy

The retinal circulation undergoes a series of pathophysiological changes in response to elevated BP. These charges are manifested as a spectrum of signs commonly referred to as hypertensive retinopathy. The significance of hypertensive retinopathy signs as risk indicators of systemic morbidity and

mortality has long been recognized. The JNC VII guidelines emphasize that hypertensive retinopathy, together with LVH, renal impairment may be considered as indicator of TOD, suggesting that physicians should consider a more aggressive approach in managing these patients.

The traditional classification of HTR, dating back to 1939 was based on work by Keith et al. The classification and its modifications typically consists of four grades of hypertensive retinopathy with increasing severity.

Grade-I: “Mild” generalized retinal arteriolar narrowing.

Grade-II: “more severe” Generalized narrowing with focal areas of anteriovenous nicking.

Grade-III: Above findings with presence of retinal haemorrhages, microaneurysms, hard exudates and cotton wool spots.

Grade-IV: Above findings with optic disc swelling and macular oedema.

Left Ventricular Hypertrophy:

In Hypertension, Left Ventricle undergoes hypertrophy as a compensatory mechanism to reduce wall stress and maintain pump function in the face of the increased after load.

LVH is an important, independent predictor of mortality and morbidity.[Levy et al 1990]

At which point LV mass cease to be compensatory and becomes deleterious in hypertension is not known, but the concept of inappropriate

LV mass or excess mass beyond that predicted based on gender, body weight and haemodynamic burden has been introduced to better address this issue.

Patients with LV hypertrophy are more likely to exhibit kidney damage, and increased carotid intima media thickness.[Cushman et al 2003]

The risk of target organ damage can be further stratified by LV geometric pattern; the risk being highest with concentric and intermediate with eccentric hypertrophy. [Devereux et al]

Concentric remodelling as well, is an independent predictor of increased cardiovascular risk in hypertensive patients. [Ciucci et al 1995].

Concentric LV hypertrophy is associated with the greatest renal dysfunction and is likely to potentiate the decline in glomerular filtration rate with aging.

MATERIALS AND METHODS

Setting : hypertension clinic (OPD) and medical wards where the patients admitted with problems related to hypertension ,Madras medical college& Govt. general hospital, Chennai-3

Collaborating Department: Department of Bio-Chemistry, Madras Medical College, Chennai – 600 003

Design of the Study : Cross Sectional Cohart Study

Period of the Study : 9 months From Feb 2010 to October 2010

Ethical Clearance : Obtained

Consent : Informed consent from all patients and controls

External Financial support : Nil

Conflict of Interest : Nil

Analysis : Date analysed using statistical package - SPSS Software

Inclusion Criteria:

Patients with primary hypertension attending Hypertension clinic and those who admitted to the medical wards with HT related problems.

Exclusion Criteria:

1) Proven cases of secondary hypertension
2) Pregnant women
3) Diabetes Mellitus
4) Established cases of kidney diseases
5) UTI
6) Established macroproteinuria
7) strenous exercise
8) CCF
9) With acute febrile illnesses
10) History of NSAID intake

Section of Study Subjects and Controls:

80 patients with Primary Hypertension (46 males and 34 females) with mean age 52.53+/-6.8 who were attending hypertension clinic and who were admitted in the medical wards of MMC, GGH for the period of 9 months from Feb 2010 to October 2010, formed the study group (cases).

The control group comprised of normotensive individuals (18 males and 22 Females) who were attendants of the study group.

Each participant was interviewed and examined indetail. The BP of each participant was measured according to JNC VII guidelines with a standardized calibrated measuring column type sphygmomanometer with an appropriate cuff encircling at least 80% of the arm and in the seated posture , with the feet on the floor and arm supposed at heart level (except in stroke patients). BP above 140/90 mm of Hg was regarded as Hypertension (JNC VII).

A detailed case record was prepared for each patient on a preformed study sheet. Detailed history taking and physical examination were performed on each patient that specifically emphasized on the assessment of the neurological status, cardiovascular status and optic fundus. Optic fundus was examined with direct Opthalmoscope.

Special investigations done:

In addition to the routine investigations like hematological and biochemical profile and work-up for secondary hypertension. The following special investigations were done

1) Fasting Lipid Profile

The patients were asked to fast for twelve hours prior to the blood sample is withdrawn. The lipid profile results were analysed on the basis of ATP-3 quidelines of the NECP

2) **ECG:** To screen for the evidence of LVH.

Sokolow – Lyon Index:

S in V1 + R in V5 or V6 more than 35mm

R in aVL more than 11mm

3) Chest Radiography: for cardiothoracic ratio

4) Computed tomography of the brain for all patients admitted with a clinical diagnosis of stroke (5 patients had stroke and all of them had MCA Territory Infarction)

5) **Microalbumunuria:** was assessed by Turbidimetric Immunoassay. 5ml of randomly voided / spot simple was used. In women urine examinations were done during non-menstrual phase of their cycles.

The kit used was FIMEMOO25, Erba Mannheim: The measuing range was in between 0 and 400mg/L. The values between 25 to 400ml/L was taken as positive for microalbuminuria.

OBSERVATION AND RESULTS

In our study 80 primary hypertensives were matched with 40 control populations for microalbuminuria.

In the study population the age group ranges from 52.16 $\pm$ 9.4.

In the control population age group ranges from 52.53 $\pm$ 6.8.

Table – 1: Age Distribution in cases and control

	Group	***N***	***Mean***	***Std. Deviation***	***Std. Error Mean***	***P Value***
Age in years	Control	40	52.53	6.809	1.077	0.829
	Cases	80	52.16	9.458	1.057	

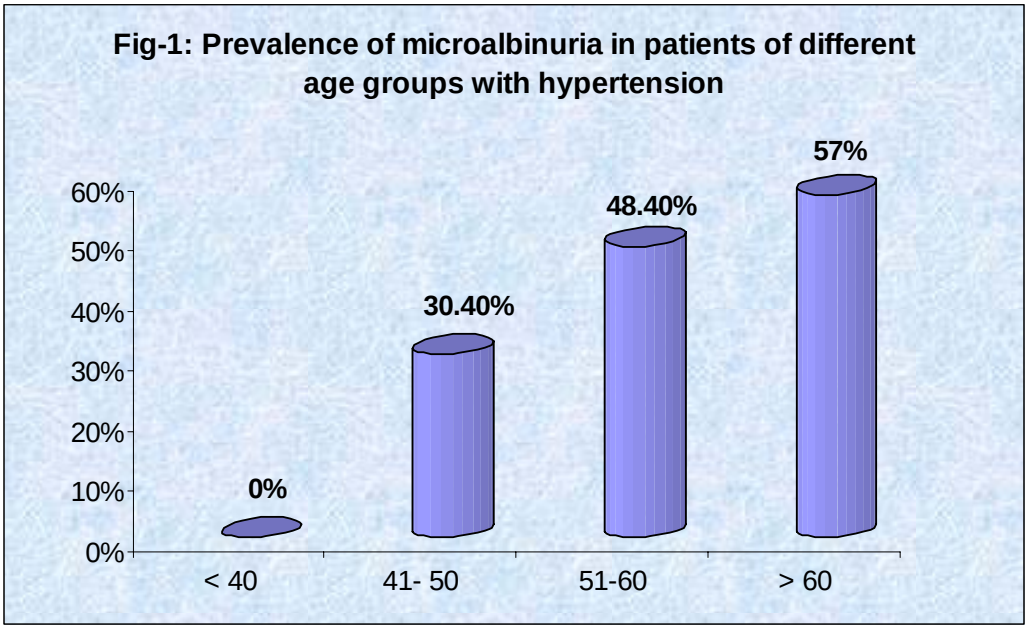


Table- 2: Sex distribution in cases and control

			Group		*Total*	*P Value*
			Control	*Cases*		
Sex	Male	Count	18	46	64	0.196
		% within Sex	28.1%	71.9%	100.0%	
		% within Group	45.0%	57.5%	53.3%	
	Female	Count	22	34	56	
		% within Sex	39.3%	60.7%	100.0%	
		% within Group	55.0%	42.5%	46.7%	

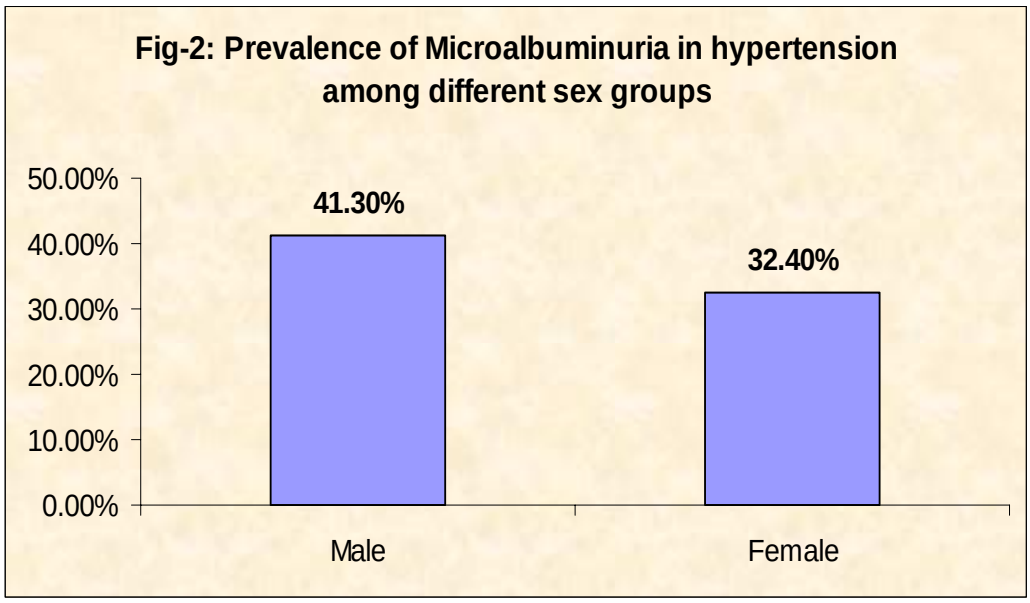
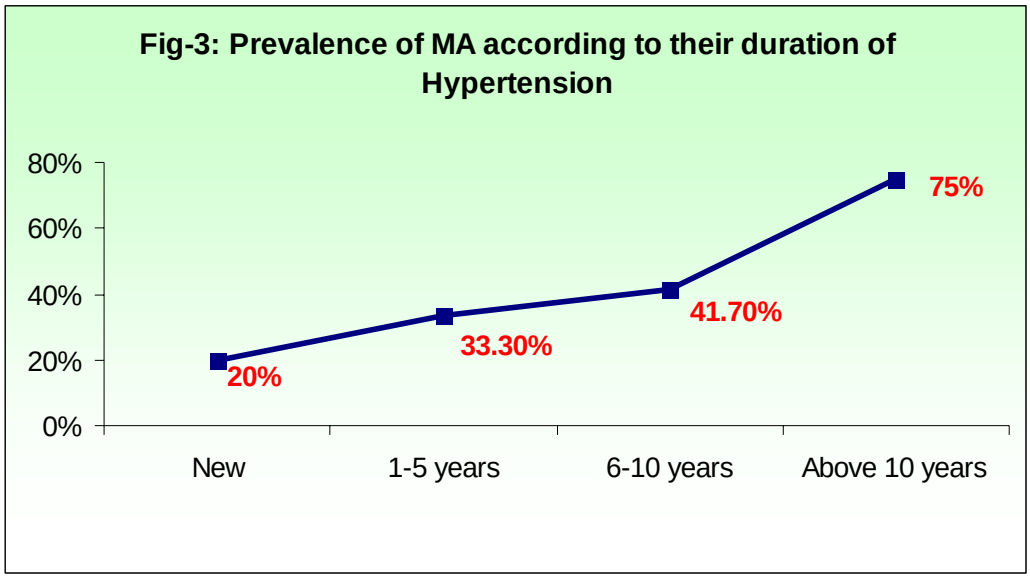


Table – 3: Prevalence of microalbinuria in patients of different age groups with hypertension.

Age Group	*No. of Cases*	*Microalbuminuria Present*		*P Value*
		No	*%*	
< 40	12	0	0%	0.009
41- 50	23	7	30.4%	
51-60	31	15	48.4%	
> 60	14	8%	57%	
Total	80	30	37.5%	

Prevalence of MA among hypertensives increased steadily with the advancing age as shown in the table (P value 0 .009).



Table–4: Prevalence of Microalbuminuria in hypertension among different sex groups

Sex	***No. of Cases***	***Microalbuminuria Present***		***P Value***
		No	***%***	
Male	46	19	41.3%	0.414
Female	34	11	32.4%	
Total	80	30	37.5%	

There was no statistically significant difference in the risk for MA between the two sex groups (P value 0.414).

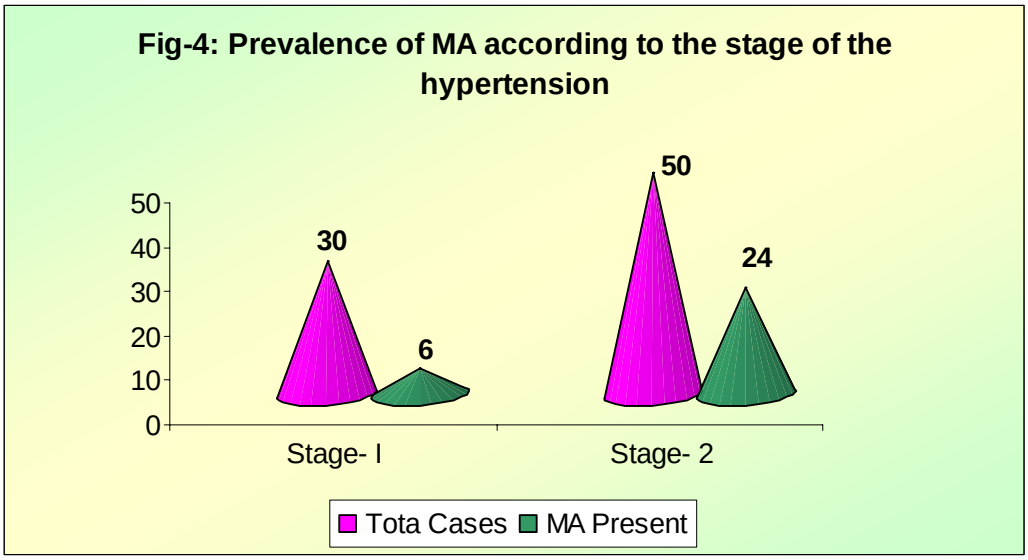


Table- 5: Prevalence of MA according to their duration of Hypertension

Duration of disease	*No. of Cases*	*Microalbuminuria Present*	
		No	*%*
New	15	3	20%
1-5 years	33	11	33.3%
6-10 years	124	10	41.7%
Above 10 years	8	6	75%

Prevalence of MA is more while the duration of disease increases.

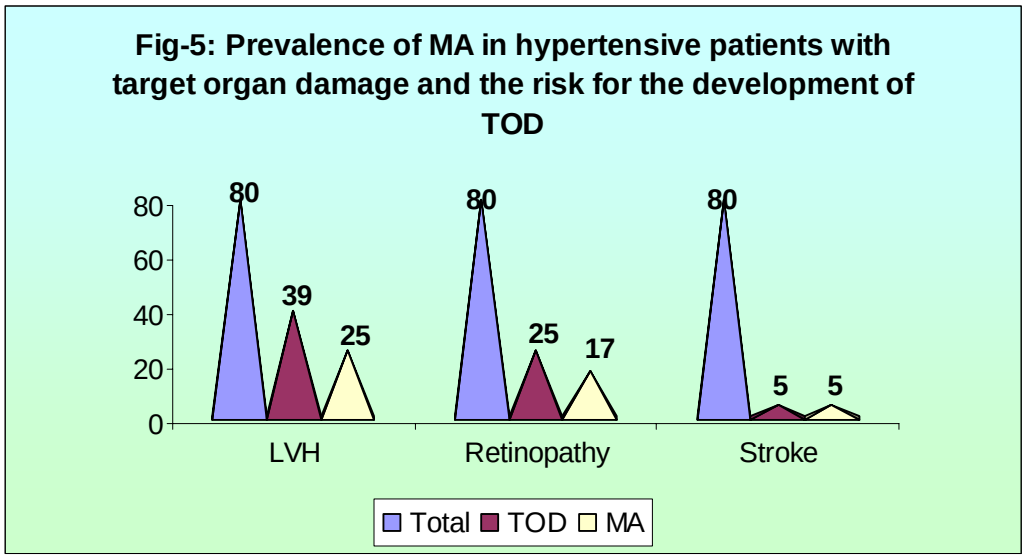


Table – 6: Prevalence of MA according to the stage of the hypertension

Stage of Hypertension	***No. of Cases***	***Microalbuminuria Present***		***P Value***
		No	***%***	
Stage- 1	30	6	20%	0.012
Stage - 2	50	24	48%	

There was statistically significant difference among the two stages of hypertension with MA (P value 0.012).

Table-7: Prevalence of MA in hypertension patients among different treatment groups

Treatment Groups	***No. of Cases***	***Microalbuminuria***		***P Value***
		No	***%***	
New cases	15	3	20%	< 0.001
Regular	37	8	21.6%	
Irregular	28	19	67.9%	

MA is present significantly higher in irregular treatment group cases (P<0.001).

Table- 8: Prevalence of Microalbuminuria in patients with hypertension when compared with total cholesterol level

			Micro albuminuria		***Total***	***P Value***
			Positive	***Negative***		
Total Cholesterol mg%	Below 240	Count	17	41	58	0.014
		% within Total Cholesterol <240 mg%	29.3%	70.7%	100.0%	
		% within Micro albuminuria	56.7%	82.0%	72.5%	
	Above 240	Count	13	9	22	
		% within Total Cholesterol ≥240mg%	59.1%	40.9%	100.0%	
		% within Micro albuminuria	43.3%	18.0%	27.5%	

Table–9: Prevalence of Microalbuminuria in patients with hypertension when compared with different triglycerate levels

			Micro albuminuria		***Total***	***P Value***
			Positive	***Negative***		
TGL mg%	Below 200	Count	27	49		0.112
		% within TGL <200mg%	35.5%	64.5%	100.0%	
		% within Micro albuminuria	90.0%	98.0%	95.0%	
	Above 200	Count	3	1	4	
		% within TGL ≥200mg%	75.0%	25.0%	100.0%	
		% within Micro albuminuria	10.0%	2.0%	5.0%	

Among 4 patients with high trigyceride levels MA was detected in 3 (75%) and MA was detected in 27 of 76 patients (35.5%) with trigycerides levels of <200mg% which was statistically insignificant (P value 0.112).

Table – 10: Prevalence of Microalbuminuria in patients with hypertension when compared with different HDL Cholesterol levels

			Micro albuminuria		***Total***	***P Value***
			Positive	***Negative***		
HDL mg%	Below 40	Count	13	8	21	0.007
		% within HDL <40mg%	61.9%	38.1%	100.0%	
		% within Micro albuminuria	43.3%	16.0%	26.3%	
	Above 40	Count	17	42	59	
		% within HDL ≥40mg%	28.8%	71.2%	100.0%	
		% within Micro albuminuria	56.7%	84.0%	73.8%	

In this study the cases with HDL level of <40mg% were 21 cases and MA was detected in 13 patients (61.9%) but patients with HDL level of >40mg% were 59 and MA was detected in 17 cases (28.8%) and the difference was found to be statistically significant.

Table- 11: Prevalence of MA in hypertensive patients with target organ damage and the risk for the development of TOD

TOD	***Cases***		***MA Present***		***P Value***	***OR (95% CI)***
	No	***%***	***No***	***%***		
LVH	39	48.8%	25	64.1%	< 0.001	27.14 (8.8-82.9)
Retinopathy	25	31.3%	17	68%	< 0.001	13.4 (4.8–3.73)
Stroke	5	6.3%	5	100%	<0.001	4.6 (3.2-6.5)

Among 80 cases, thrombotic stroke was found in 5 (6.3%) and the MA was detected in all cases that was statistically significant.

Among the hypertensive patients LVH was present in 39 (48.8%) cases and the MA was detected in 25(64.1) cases which was statistically significant. Hypertensive retinopathy was noted in 25(31.3%) cases among which MA was demonstrated in 17(68%) which is statistically significant (P value <0.01).

DISCUSSION

In our study, there were 80 patients with 40 control subjects compared. The mean age of study patients were 52.16 +/- 9.4 and in control were 52.53 +/- 6.8 and P value is (0.829). So almost same age groups were selected.

Among 80 patients 46 were male and 34 were females and in control population males were 19 and females were 22 and P value was 0.16 (> 0.05). Sex groups were also not statistically significant.

The overall presence of micro albuminuria in primary hypertension is 37.5% which is higher than the prevalence observed in Life study (23%) (Wachtell K el al, 2002). So our observation on high prevalence of MA in patients with primary hypertension must alert the clinicians regarding the high prevalence of subclinical CKD in this part of the world especially in view of observations made by Mani MK from south India (ManiMK et al, 2009) on the strategies for reduction of the burden of CKD by early detection and treatment for hypertension.

It was observed the prevalence of MA among primary hypertensives (increased steadily with the advancing age (P value – 0.009 significant). This finding is comparable with that of the study conducted by Hitha B et al, 2008. So advancing age is found to be a risk factor for higher prevalence of MA in our study also as observed. (Tsioutis et al 2005).

There was no statistically significant difference in the prevalence of MA among males and females hypertensives. (P value 0.414)

It was observed that prevalence of MA steadily increased according to their duration of the disease.

There was statistically significant difference among the two stages of hypertension with microalbuminuria (P=0.012).The prevalence is more with stage 2 Hypertensive (P Value 0.012)

The prevalence of MA in patient with regular treatment was lesser when compared with patients on irregular treatment. So strict round the clock control of high BP is important in reducing the risk of MA in hypertensives because even isolated

ambulatory hypertension is associated with higher risk for TOD (Torun D et al, 2009).

Prevalence of MA in patient with primary hypertension with unfavourable Lipid Profile is more when compared to patients with favourable lipid profile.

In patients with hypertension, LVH is one of the earliest TOD like MA (Messerli fit et al 2001) and there is a significant association between these two subtle TOD's as shows in many studies.

The prevalence of LVH found in our world was 48.8% through the prevalence of LVH reported in other studies was low. The prevalence of LVH according to Hitha B et al was 29.33%

But the higher the odds for LVH in cases with MA (OR=27.14) implies higher risk for cardiovascular events in the study population with hypertension.

Early screening of hypertensive patients for MA and aggressive management of positive cases with drugs that reduce MA, might reduce their higher risk, for progression to severe CKD

and adverse cardiovascular outcomes as shows in many studies (Assadi F et al, 2001, Amold JM et al ,2003)

MA had been reported to be three times more prevalent in patients with recent stroke (Beamer NB at al, 1999) and the risk for the future stroke had been found to be high among patients with MA. (Wachtell K et al, 2003). MA was more prevalent among patients with stroke (OR=4.6) in the present study as well.

The prevalence of MA was also higher among those with hypertensive retinopathy in our study. ($P < 0.001$).

The risk for the development of retinopathy in patients with primary hypertension and microalbuminuria is higher (OR 13.4).

Several studies have indicated that the presence of MA is a independent predictor of cardiovascular morbidity and mortality in patients with primary hypertension (Jalal S et al, 2001). Our study also shows that microalbuminuria is more prevalent in primary hypertensives with TOD.

CONCLUSION

The following conclusions were derived from our study,

- Prevalence of microalbuminuria is common primary hypertensives and is around 37.5%.
- Patients with advanced age and longer duration of hypertension develop MA.
- Sex differences do not pose any significant risk for the developmentof microalbuminuria.
- There is a possible correlation between the severity of hypertension and microalbuminuria.
- Prevalence of MA is more in Patients with primary hypertension in the presence of unfavourable lipid profile.
- These is higher risk of development of TOD in patients with microalbuminuria among primary hypertension.
- Prompt and adequate control of BP delays progression to TOD in patients with MA and hence a more aggressive approach is required in hypertension with MA.

SUMMARY

Primary hypertension is a major health problem through out the world causing coronary, cerebral and renal vascular disease. Our study shows that the prevalence of microalbuminuria in patients with primary hypertension is 37.5% and has a positive correlation with the severity of hypertension and thus may be an early marker for end organ damage susceptibility. This study implies that early screening of primary hypertension of MA and prompt treatment of positive cases might reduce the disease burden related to severe CKD, cardiovascular events in the community.

S.No	Name	Age	Sex	yrs	Stage of HTN	TREATMENT	Total Cholesterol mg%	TGL mg%	HDL mg%	Micro albuminuria	ECG- LVH	Echo-LVH	Retinopathy
1	subramani	60	M	7	2	REGULAR	210	168	54	-	+	+	II
2	EGAMBARAM	62	M	4	2	IRREGULAR	198	208	48	POSITIVE	+	+	II
3	RANI	60	F	NEW	2	N K	257	152	48	POSITIVE	+	-	-
4	SUGANTHI	51	F	2	1	REGULAR	186	120	38	-	+	+	-
5	POOSAMMAL	59	F	1	2	REGULAR	256	182	40	-	+	+	+
6	GNANAM	41	F	1	1	REGULAR	228	156	54	-	-	-	-
7	BALAKRISHNAN	55	M	12	2	IRREGULAR	258	158	46	POSITIVE	-	+	-
8	KAMALA	50	F	4	1	REGULAR	220	150	40	-	-	-	-
9	SELVI	40	F	3	1	REGULAR	250	152	46	-	-	-	-
10	RAMASAMI	62	M	10	2	IRREGULAR	189	143	51	POSITIVE	+	+	+
11	BALU	41	M	4	2	REGULAR	257	152	48	-	-	-	-
12	CHITRABABU	56	F	6	1	REGULAR	252	143	48	-	-	-	-
13	ABDUL RAHMAN	70	M	15	2	IRREGULAR	184	105	41	-	-	+	-
14	SYED KHADAR	78	M	14	1	REGULAR	200	120	40	POSITIVE	+	+	+
15	SUBBAN	62	M	10	2	IRREGULAR	200	156	41	-	+	+	+
16	VELU	42	M	NEW	2	N K	198	141	54	-	-	-	-
17	KUPPUSAMY	39	M	NEW	1	N K	221	176	51	-	-	-	-
18	SARASU	36	F	NEW	2	N K	287	134	41	-	-	-	-
19	VISALATCHI	62	F	8	2	IRREGULAR	200	129	57	POSITIVE	+	+	+

S.No	Name	Age	Sex	yrs	Stage of HTN	TREATMENT	Total Cholesterol mg%	TGL mg%	HDL mg%	Micro albuminuria	ECG- LVH	Echo-LVH	Retinopathy
20	MANI	42	M	2	2	REGULAR	233	159	44	POSITIVE	+	-	+
21	KRISHNAN	62	M	12	1	REGULAR	174	110	41	-	+	+	-
22	PARTHASARATHY	60	M	6	2	REGULAR	199	109	43	-	-	+	-
23	SRINIVASAN	51	M	5	2	IRREGULAR	200	140	51	POSITIVE	+	+	-
24	SATHYANESAN	44	M	3	1	REGULAR	196	94	58	-	-	-	-
25	ALAGAPPAN	39	M	NEW	2	N K	210	99	53	-	-	-	-
26	THANGAMMAL	39	F	NEW	2	N K	200	161	42	-	-	-	-
27	SUBBURAJ	59	M	9	2	IRREGULAR	298	200	40	POSITIVE	+	+	+
28	KANTHA	49	F	NEW	2	N K	199	113	40	-	-	-	-
29	SUMATHY	41	F	3	2	REGULAR	221	132	49	-	-	-	-
30	VASANTHA	50	F	8	1	REGULAR	183	105	50	-	-	-	-
31	AMUTHA	40	F	7	2	IRREGULAR	211	144	41	-	-	-	-
32	AYYAVU	53	M	6	2	REGULAR	192	106	50	-	+	+	+
33	GOVINDHAN	60	M	14	2	IRREGULAR	280	196	40	POSITIVE	+	+	+
34	SARATHAMBAL	55	F	8	1	REGULAR	197	139	45	-	-	-	-
35	SEETHA	60	F	9	2	IRREGULAR	281	188	43	POSITIVE	+	+	+
36	GURUMOORTHY	39	M	NEW	1	N K	210	98	53	-	-	-	-
37	SANTHANAM	55	M	4	2	REGULAR	185	100	50	POSITIVE	-	-	-
38	SABESAN	40	M	1	2	IRREGULAR	284	199	46	-	-	-	-
39	NALINI	41	F	2	1	REGULAR	187	115	49	-	-	-	-

S.No	Name	Age	Sex	yrs	Stage of HTN	TREATMENT	Total Cholesterol mg%	TGL mg%	HDL mg%	Micro albuminuria	ECG- LVH	Echo-LVH	Retinopathy
40	SIVAMOORTHY	56	M	1	2	REGULAR	174	108	50	-	-	-	-
41	KAMALAMMAL	65	F	2	2	IRREGULAR	304	200	38	POSITIVE	+	+	+
42	PALANISAMY	51	M	NEW	1	N K	197	142	49	-	-	-	-
43	SUBATHRA	40	F	1	2	REGULAR	201	140	51	-	-	-	-
44	CHELLAMMAL	59	F	3	1	IRREGULAR	184	205	50	-	-	-	-
45	SUNDARAM	59	M	7	2	REGULAR	281	193	50	POSITIVE	+	+	+
46	SAVARTMUTHU	50	M	3	2	IRREGULAR	206	186	50	POSITIVE	+	+	-
47	LILLY	43	F	NEW	2	N K	210	142	56	-	-	-	-
48	JOSEPH	50	M	4	2	IRREGULAR	180	147	56	-	+	+	+
49	VENI	42	F	1	2	REGULAR	174	192	52	-	-	-	-
50	VALARMATHY	59	F	11	2	IRREGULAR	199	104	41	POSITIVE	+	-	+
51`	VARATHARAJAN	51	M	8	1	IRREGULAR	198	280	40	POSITIVE	-	+	-
52	PERIASAMY	61	M	6	1	REGULAR	162	141	42	-	+	+	+
53	DURAISAMY	49	M	NEW	2	N K	210	132	59	-	+	-	-
54	SOUNDARAM	49	F	9	2	IRREGULAR	256	200	38	POSITIVE	-	+	+
55	ANDAPPAN	60	M	4	2	REGULAR	211	192	41	POSITIVE	+	+	+
56	MARY	57	F	NEW	2	N K	300	199	42	POSITIVE	+	+	+
57	VEERAMUTHU	60	M	6	1	REGULAR	188	123	42	-	-	-	-
58	SARASWATHYAMMAL	59	F	10	2	REGULAR	152	141	39	-	+	+	+
59	ESWARAN	40	M	1	2	REGULAR	180	140	52	-	-	-	-

S.No	Name	Age	Sex	yrs	Stage of HTN	TREATMENT	Total Cholesterol mg%	TGL mg%	HDL mg%	Micro albuminuria	ECG- LVH	Echo-LVH	Retinopathy
60	PRAKASAM	42	M	4	2	IRREGULAR	206	166	40	POSITIVE	+	-	-
61	MANI	51	M	NEW	2	N K	199	140	43	POSITIVE	-	+	-
62	MUTHUSAMY	49	M	4	1	REGULAR	271	200	40	POSITIVE	+	+	+
63	KALPANA	50	F	2	2	IRREGULAR	244	154	40	POSITIVE	+	-	-
64	KANAGAM	49	F	1	1	REGULAR	174	162	49	-	-	+	-
65	SWAMINATHAN	39	M	1	1	REGULAR	202	140	52	-	-	-	-
66	KESAVAN	41	M	NEW	2	N K	182	146	50	-	-	-	-
67	MEENAKSHI	61	F	4	1	REGULAR	174	151	49				
68	SRIRAM	38	M	NEW	1	N K	199	141	50	-	-	-	-
69	KRISHNAVENI	68	F	20	2	IRREGULAR	195	124	39	POSITIVE	+	+	-
70	RUCKMANI	57	F	3	2	IRREGULAR	200	142	51	-	-	+	-
71	RAMAKRISHNAN	70	M	9	1	REGULAR	187	122	40	POSITIVE	+	+	+
72	LAKSHMIAMMAL	61	F	11	2	IRREGULAR	241	183	41	POSITIVE	+	+	-
73	NAGALAXMI	43	F	4	1	REGULAR	284	195	40	-	+	-	+
74	RANGACHARI	70	M	6	1	REGULAR	195	-	-	-	-	-	-
75	LOGANATHAN	52	M	1	2	REGULAR	270	150	41	-	+	+	-
76	SUNDARI	52	F	6	1	REGULAR	184	174	38	POSITIVE	+	-	+
77	GANAPATHY	49	M	8	2	IRREGULAR	287	210	40	POSITIVE	+	+	-
78	VADIVEL	51	M	5	1	IRREGULAR	170	107	46	POSITIVE	+	-	-
79	RAMARAO	60	M	8	1	IRREGULAR	218	173	40	-	+	+	-

S.No	Name	Age	Sex	yrs	Stage of HTN	TREATMENT	Total Cholesterol mg%	TGL mg%	HDL mg%	Micro albuminuria	ECG- LVH	Echo-LVH	Retinopathy
80	RAJARAM	55	M	10	1	IRREGULAR	253	184	40	-	+	+	-
81	GOMATHY	40	F	C0NTROL	C	C	180	100	51	-	-	-	-
82	JEYA	55	F	C0NTROL	C	C	201	148	51	-	-	-	-
83	SULOCHANA	48	F	C0NTROL	C	C	170	154	49	-	-	-	-
84	CHELLAMMAL	49	F	C0NTROL	C	C	198	142	48	-	-	-	-
85	POONGOTHAI	59	F	C0NTROL	C	C	160	170	48	-	-	-	-
86	SELVARAJ	60	M	C0NTROL	C	C	174	147	51	-	-	-	-
87	PALANI	42	M	C0NTROL	C	C	139	159	56	-	-	-	-
88	MANIVEL	59	M	C0NTROL	C	C	208	169	46	-	-	-	-
89	TAMILSELVAM	51	M	C0NTROL	C	C	236	136	51	-	-	-	-
90	KRISHNAN	62	M	C0NTROL	C	C	162	191	50	-	-	-	-
91	SYEDFATHIMA	67	F	C0NTROL	C	C	210	150	48	-	-	-	-
92	PONNAMMAL	57	F	C0NTROL	C	C	154	141	43	-	-	-	-
93	SAROJAMMAL	60	F	C0NTROL	C	C	99	105	40	-	-	-	-
94	PAPPU	59	F	C0NTROL	C	C	181	141	43	-	-	-	-
95	MEENAKSHIAMMAL	50	F	C0NTROL	C	C	160	112	42	-	-	-	-
96	VELANKANNI	49	F	C0NTROL	C	C	173	142	49	-	-	-	-
97	TARA	40	F	C0NTROL	C	C	199	171	52	-	-	-	-
98	RAMAN	57	M	C0NTROL	C	C	184	144	51	-	-	-	-
99	THANGARAJ	52	M	C0NTROL	C	C	174	151	47	-	-	-	-

S.No	Name	Age	Sex	yrs	Stage of HTN	TREATMENT	Total Cholesterol mg%	TGL mg%	HDL mg%	Micro albuminuria	ECG- LVH	Echo-LVH	Retinopathy
100	MURUGESAN	54	M	C0NTROL	C	C	141	172	42	-	-	-	-
101	PANDI	64	M	C0NTROL	C	C	185	171	41	-	-	-	-
102	MUTHUMANICKAM	61	M	C0NTROL	C	C	147	123	51	-	-	-	-
103	RAJASEKAR	49	M	C0NTROL	C	C	188	150	46	-	-	-	-
104	MANIKANDAN	40	M	C0NTROL	C	C	197	141	49	-	-	-	-
105	RAJADURAI	55	M	C0NTROL	C	C	200	149	50	-	-	-	-
106	AMAMMANIAMMAL	59	F	C0NTROL	C	C	168	98	41	-	-	-	-
107	MALATHY	49	F	C0NTROL	C	C	199	89	54	-	-	-	-
108	LATHA	46	F	C0NTROL	C	C	142	111	41	-	-	-	-
109	KAMARAJ	51	M	C0NTROL	C	C	174	112	51	-	-	-	-
110	VADIVU	49	F	C0NTROL	C	C	188	121	42	-	-	-	-
111	MEIKANDAN	50	M	C0NTROL	C	C	154	141	49	-	-	-	-
112	DIVAKAR	46	M	C0NTROL	C	C	179	140	56	-	-	-	-
113	THIARAJAN	61	M	C0NTROL	C	C	180	154	48	-	-	-	-
114	KANNAN	54	M	C0NTROL	C	C	200	153	51	-	-	-	-
115	MANGAI	56	F	C0NTROL	C	C	210	140	42	-	-	-	-
116	MUTHAMMAL	50	F	C0NTROL	C	C	220	151	40	-	-	-	-
117	KAMATCHI	49	F	C0NTROL	C	C	151	112	39	-	-	-	-
118	MALLIGA	44	F	C0NTROL	C	C	184	154	50	-	-	-	-
119	LEEMA	50	F	C0NTROL	C	C	171	141	50	-	-	-	-

S.No	Name	Age	Sex	yrs	Stage of HTN	TREATMENT	Total Cholesterol mg%	TGL mg%	HDL mg%	Micro albuminuria	ECG- LVH	Echo-LVH	Retinopathy
120	DAISY	48	F	C0NTROL	C	C	198	89	41	-	-	-	-

CVA
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-

CVA
-
-
-
-
-
-
-
PRESENT+
-
-
-
-
-
PRESENT+
-
-
-
-
-
-

CVA
-
PRESENT+
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-

CVA
-
-
-
-
-
-
-
-
PRESENT+
-
PRESENT+
-
-
-
-
-
-
-

CVA
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-

CVA
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-

CVA
-

A STUDY ON BIOCHEMICAL MARKERS IN PRIMARY HYPERTENSION IN CORELATION WITH TARGET ORGAN DAMAGE

Name: Age: Sex:

Address: Occupation:

Duration of Hypertension:

SYMPTOMS:

- ☐ Headache
- ☐ Giddiness
- ☐ Blurring of vision
- ☐ Epistaxis
- ☐ Chest Pain
- ☐ Palpitation
- ☐ Dyspnea
- ☐ Fever
- ☐ Loin Pain
- ☐ Oliguria
- ☐ Puffiness of Face
- ☐ Swelling of legs
- ☐ Anorexia
- ☐ Vomiting/Hiccups
- ☐ Easy fatiguability
- ☐ Altered bowel habits
- ☐ Dysuria
- ☐ Cold intolerance
- ☐ Weight gain
- ☐ Hoarseness of voice
- ☐ Centripetal obesity
- ☐ Hirsutism
- ☐ Amenorrhea/Menorrhagia
- ☐ Proximalmuscle weakness
- ☐ Hypogastric Pain

PAST HISTORY:

- ☐ DM
- ☐ Renal disorders
- ☐ Chronic Liver disorders
- ☐ Thyroid Disorders

DRUG INTAKE

- ☐ NSAIDS

PERSONAL HISTORY:

- ☐ Smoking
- ☐ Alcoholism
- ☐ Drug abuse
- ☐ STD
- ☐ Prolonged Starvation
- ☐ Exercise

FAMILY HISTORY:

- ☐ Hypertension
- ☐ DM
- ☐ Chronic kidney disease

GENERAL EXAMINATION:

Anthropometry:

Ht: cms Wt: kgs BMI:

Hydration Status JVP

FUNDUS:

Features of Thyroid Disorders:

Features of Cushing's Syndrome:

PULSE:

BLOOD PRESSURE:

Rt Lt

Stage of Hypertension

SYSTEMIC EXAMINATION:

CVS: RS: ABDOMEN: CNS:

INVESTIGATIONS:

Hb: TC: DC: P- L- E- M- Plt:

ESR :

Blood Glucose Fasting :

Blood Urea :

Serum Creatinine :

Uric Acid :

Serum Electrolytes : Na+ K+

LIPID PROFILE:

Total Cholesterol : HDL :

Triglycerides : LDL :

Chol: HDL Ratio : VLDL :

LIVER FUNCTION TEST:

Bilirubin Total :
Direct :

SGOT :

SGPT :

Total Protein :
Albumin :
Globulin :

Sr. Alkaline Phosphatase :

URINE EXAMINATION:

Micro Albumin : Deposits:

Albumin :

Sugar :

ECG:

X-RAY CHEST PA VIEW :

ECHO CARDIOGRAM :

USG ABDOMEN :